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STATE: MONTANA STATEWIDE FISHERIES INVESTIGATIONS

PROJECT NO: F-46-R-5 SURVEY AND INVENTORY OF COLDWATER LAKES

JOB NO: II-f HAUSER AND HOLTZER RESERVOIRS STUDY

PROJECT PERIOD JULY 1, 1996 THROUGH JULY 1, 1997

Abstract: Fisheries data were gathered on Hauser and Holter reservoirs to provide information needed to: 1) manage the fishery of the two reservoirs; 2) evaluate impacts of existing reservoir operations on the sport fishery; and 3) evaluate the success of the hatchery stocking program. In Hauser Reservoir, 763 anglers were surveyed during the 1996 summer creel. Angler catch rates for kokanee were the lowest on record at 0.10 fish per hour. Catch rates for rainbow trout were unchanged from 1995 at 0.05. Fishing for yellow perch improved sharply in 1996 with a summer catch rate of 0.31. As a result of poor kokanee fishing, only 24.2% of the anglers interviewed during the summer creel said they were satisfied with fishing on Hauser Reservoir. In 1996, combined harvest of kokanee and rainbow trout in Hauser Reservoir was about 30,000 fish, well below the management goal of 80,000.

The composition of fish species in trend nets in Hauser Reservoir was similar to catches in previous years. Kokanee dominated the catch in floating and vertical gill nets, while white suckers dominated the sinking gill net catch. Total summer catch of kokanee in vertical gill nets was down from 1995. The decline was due to a very weak year class -the lowest on record- of age-1 kokanee. Hydroacoustic estimates of pelagic fish abundance in Hauser Reservoir declined by approximately 50% from 1995.

In Holter Reservoir, a total of 1,036 anglers were interviewed during the summer creel survey. Rainbow trout dominated angler catch (48.4%), followed by kokanee (37.4%), yellow perch (10.3%) and walleye (3.7%). The 1996 catch rate for rainbow trout was 0.21 per hour, which was a significant improvement from 1995 (0.16 rainbow per hour). About 90% of the rainbow trout harvested by anglers were of known hatchery origin, while 80% of rainbow trout captured in gill nets were of hatchery origin. The contribution of wild fish in gill net catches was much lower than normal (45%). Answers to angler-satisfaction questions revealed that 36.3% of the anglers were satisfied with the number of fish they caught, while 62.0% of the anglers who caught fish were satisfied with fish size. During the winter ice fishery, angler catch rates for yellow perch were very poor (0.65 fish per hour). The average winter catch rate for yellow perch between 1989 and 1995 was 3.3 fish per hour. Conversely, the winter catch rate for rainbow trout was above average at 0.25 fish per hour.

Rainbow trout and kokanee dominated the catch in the spring and fall floating gill nets. Yellow perch, white suckers and longnose suckers dominated the catch in both spring and fall sinking gill nets. Fall catch rates for walleye in sinking nets increased from a record low of 0.5 fish per net in 1995 to 2.5 walleye in 1996. The average length of walleye in the spring and fall nets was 20.1 and 20.3 inches, respectively. The total summer catch for kokanee in the vertical gill nets dropped from the record high in 1995, but was still well above average. Most of the kokanee caught in vertical nets were age-2. Trap nets were fished for 45 net nights and captured 97 spawning walleye. A total of 64 walleye were tagged with jaw tags; the remaining 33 fish had been previously tagged. The percent of previously tagged walleye caught in traps nets has increased from 3% in 1995 to 34% in 1997. Perhaps the most surprising result from the walleye tagging effort has been the number of tagged fish being caught below Holter Dam. Since 1995, 64% (18 of 28) of tag returns were from walleye caught below Holter Dam.

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PROCEDURES

The study area has been previously described by Rada (1974), Berg and Lere (1983) and MDFWP (1985). A map of the two reservoirs is presented in Figure 1. Reservoir fish were sampled with floating and sinking 6 x 125 foot experimental gill nets (0.75 to 2 inch mesh). Nets were set in each reservoir during the spring and fall in similar locations to those used between 1986-1995. Distribution of fish species by depth was determined by using a gang of six vertical gill nets that were 150 feet deep and 12 feet wide (0.5, 0.75, 1, 1.25, 1.5 and 2.0 inch mesh). Vertical nets were set monthly from April through November at permanent sampling stations located at the lower end of each reservoir (the Dam station on Hauser Reservoir and the Jackson station on Holter Reservoir) and mid-reservoir (below the powerlines) on Hauser Reservoir. Single-lead trap nets (4 x 6 foot frame with either 1" or ½" mesh) were used to sample spawning walleye on Holter Reservoir in spring 1997. A partial creel census was conducted on Hauser and Holter reservoirs from early April through late October. Procedures for this partial creel census are described in Lere (1987). An additional partial creel survey was conducted during ice cover on the two reservoirs from early January through early March. Hydroacoustic methods used to estimate pelagic fish densities and total fish abundance are described in Skaar and Humphrey (1995). In 1996, hydroacoustic surveys were completed between 15 and 22 April.

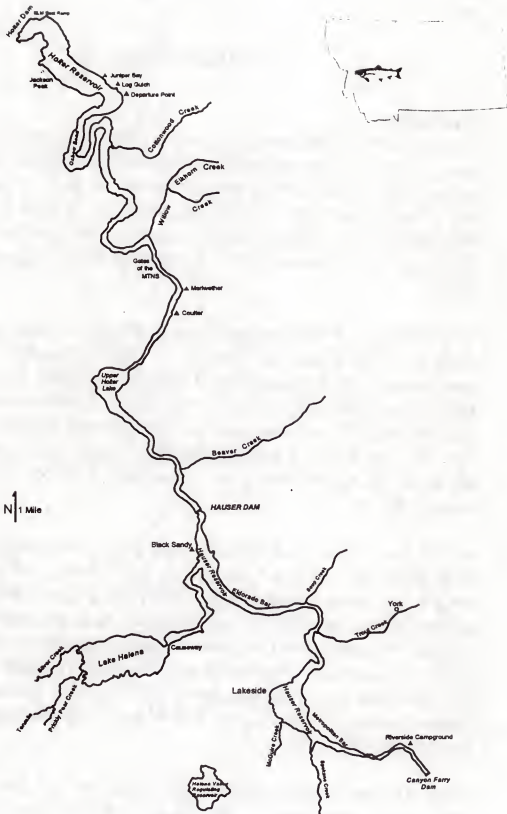


Figure 1. Map of Hauser, Holter and the Helena Valley Regulating Reservoirs.

Hauser Reservoir

Creel Surveys

Summer Creel: In 1996, a total of 763 anglers were interviewed during the weekend summer creel on Hauser Reservoir. Average time spent fishing was 3.1 hours for shore anglers (425 interviews) and 5.1 hours for boat anglers (338 interviews). Total catch was 764 yellow perch, 238 kokanee, 135 rainbow, and 15 brown trout. Catch rates for each species varied greatly by season (Figure 2). Kokanee fishing was best in June. Yellow perch catch rates peaked in August and September followed by rainbow trout in October.

In 1996, overall summer catch rates for rainbow trout remained stable at 0.05 fish per angler hour. The ten year average was 0.11 rainbow per angler hour (Table 1). Catch rates for rainbow have dropped sharply since the late 1980's. The decline in catch rates can be explained by reductions in the number of rainbow planted each year. Annual rainbow plants were reduced from about 200,000 fish in the 1980's to roughly 100,000 in recent years (Figure 3). Using data collected since 1986, stocking densities explained 78% of the variance in angler catch rates ($P < 0.001$) for rainbow trout in Hauser Reservoir.

In 1995 and 1996, the mean length for rainbow in the creel increased to 17.5". Prior to 1995, total length of rainbow trout averaged 15.0" (Table 1). The recent increase in mean length may have resulted from a boost in the number of larger Canyon Ferry rainbow being caught. Approximately 34% of the rainbow creeled in 1996 were Desmet or Eagle Lake drifters from Canyon Ferry. Historically, less than 5% of the rainbow caught during the summer creel originated from Canyon Ferry plants. Creeled Desmet and Eagle Lake rainbow averaged almost 19". The recent increase in Canyon Ferry rainbow trout may be related to spill. Record amounts of water spilled during spring runoff in 1995 and 1996.

Kokanee harvest in Hauser Reservoir declined from an estimated 141,000 in 1991 to only 17,000 in 1996 (Table 1). The 1996 catch rate for kokanee dropped to 0.10 fish per hour, a ten year low. The average length of kokanee also dropped from 15.7" to 14.1". The reduction in size was due to the dominance of age-2 kokanee in the creel.

Angler responses to questions regarding satisfaction with the fishing at Hauser Reservoir were consistent with lower than normal catch rates. The majority of respondents were very dissatisfied with the number of fish caught (Figure 4). However, the majority of anglers surveyed (60%) were satisfied with overall fish size.

Table 1. Summer catch rates, mean size, and harvest of selected species in Hauser Reservoir. Harvest estimates include winter ice fishing.

Year	RAINBOW			KOKANEE			YELLOW PERCH		
	Catch rate (fish/hr)	Mean Size (inches)	Harvest (X 1000)	Catch rate (fish/hr)	Mean Size (inches)	Harvest (X 1000)	Catch rate (fish/hr)	Mean Size (inches)	Harvest (X 1000)
1986	0.25	13.5	-	0.10	16.6	-	0.13	8.6	-
1987	0.24	14.2	-	0.13	15.6	-	0.12	9.7	-
1988	0.24	15.8	-	0.24	16.3	-	0.06	9.6	-
1989	0.12	13.7	25.5	0.42	14.6	101.4	0.10	7.7	27.2
1990	0.10	14.9	27.8	0.22	15.7	60.9	0.17	8.9	38.9
1991	0.02	15.3	7.8	0.46	14.7	141.3	0.08	8.1	36.8
1992	0.05	15.1	13.0	0.22	15.8	78.4	0.16	9.0	55.4
1993	0.05	16.3	16.5	0.22	16.0	89.3	0.05	9.0	49.4
1994	0.02	16.6	4.2	0.15	14.8	37.1	0.15	10.6	38.2
1995	0.05	17.5	11.5	0.11	17.0	29.1	0.16	8.9	23.2
1996	0.05	17.5	11.7	0.10	14.1	17.4	0.31	9.4	35.0
Mean	0.11	15.5	14.8	0.22	15.6	69.4	0.14	9.0	38.0

Harvest estimates for 1986 - 88 were not estimated because creel surveys were not completed during winter months.

Winter Creel: The 1996 ice fishing season stands out from other years because fewer anglers were interviewed than normal and the total combined catch of all species was the lowest on record (Table 2). The majority (80%) of the 247 anglers interviewed were from the Helena area and they spent on average 3.25 hours fishing. Yellow perch dominated the catch at 108, followed by 30 rainbow, 2 brown trout and 1 kokanee. Only one kokanee was creeled on Hauser Reservoir during the 1996 ice fishing season.

Table 2. Total catch, number of interviews and angler catch rates from winter creel surveys on Hauser Reservoir.

Year	# of	total	catch rates			
			rainbow	brown	kokanee	yellow
1989	573	288	0.18	0.01	0.23	0.20
1990	300	337	0.11	<0.01	0.18	0.20
1991	395	723	0.08	0.01	0.18	0.60
1992	566	1,177	0.02	<0.01	0.30	0.45
1993	635	2,234	0.04	0.01	0.47	0.88
1994	197	224	0.01	0.02	0.03	0.76
1995	323	624	0.04	<0.01	0.03	0.45
1996	247	141	0.04	<0.01	<0.01	0.15

Trend Netting and Hydroacoustic Estimates of Fish Abundance

Floating Gill Nets: Species composition for spring and fall horizontal gillnets are shown in Appendix A - D. In 1996, spring catch in floating nets was 1.67 rainbow trout per net. Fall netting yielded 3.64 rainbow per floating horizontal. Similar to creel data, the contribution of fish originating from Canyon Ferry was high. In 1996, almost 50% of the rainbow collected in trend nets were drifters from Canyon Ferry (Figure 5). The contribution was even higher in 1995 at 87%.

Vertical Gill Nets: Total catch of kokanee was down from 1995. The decline was largely due to a poor age-1 year class (Figure 6). The 1996 catch of age-1 kokanee was the lowest on record. The age-2 cohort was similar to catches from previous years (Figure 6). To estimate fecundity, egg samples were collected from 41 kokanee. Females sampled for fecundity averaged 17.9" and carried on average 1,880 eggs.

Beach Seine: Beach seine results are shown in Table 3. Yellow perch numbers increased from 1995 and were the highest observed since 1992. Most of the perch sampled were age-0. Sucker numbers were also up from 1995.

Table 3. Number of fish per beach seine in Hauser Reservoir 1990-1995.

Year	Number of Tows	Y. Perch	Sucker	Walleye
1990	2	15.5	--	0.0
1991	20	36.6	--	0.0
1992	20	1153.1	107.6	0.0
1993	20	145.0	1105.9	0.0
1994	20	52.8	729.6	0.0
1995	20	47.0	187.5	0.1
1996	19	232.0	573.6	0.0

Hydroacoustic Estimates of Kokanee Abundance:

Similar to the 1995 analysis, hydroacoustic transects from Eldorado Bar downstream to the Dam and the lower half of the Causeway Arm were used to estimate kokanee abundance (areas described are shown in Figure 1). The mid and upper sections of the reservoir were excluded from analysis because very few kokanee were sampled in gill nets above the Eldorado Bar. Target densities ranged from 287 to 397 fish per acre. Densities were greatest in the Causeway Arm and lowest in the Black Sandy area (Figure 7). Total fish abundance in the lower section of the reservoir was 400,000 ± 100,000. Results from vertical gill nets indicated that 80.9% of the targets were kokanee, followed by sucker sp. (12.7%), rainbow trout (4.8), and yellow perch (1.6%).

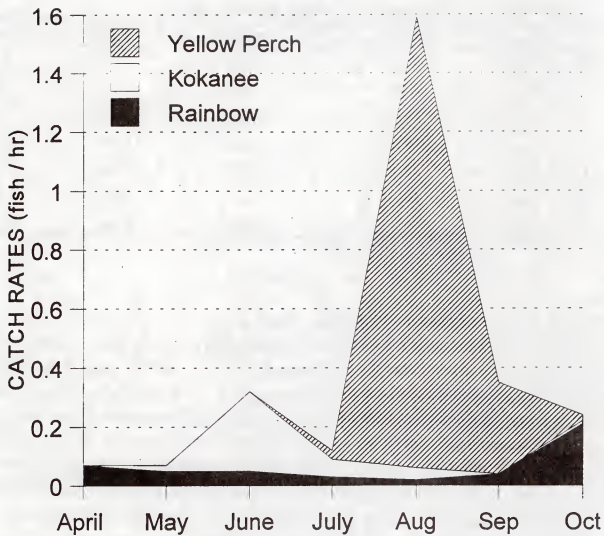


Figure 2. Seasonal catch rates for selected species in Hauser Reservoir.

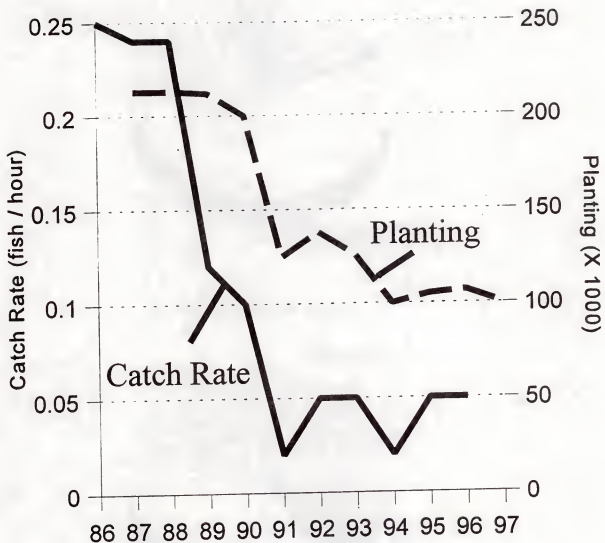


Figure 3. Rainbow planting records and angler catch rates in Hauser Reservoir. Planting records were offset one year to reflect the period when the plant has the greatest impact on the fishery.

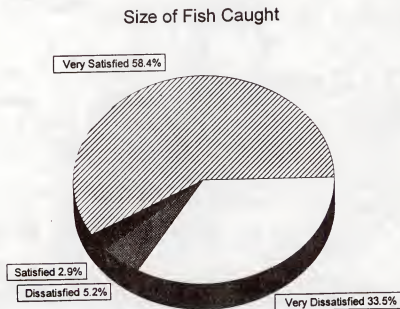
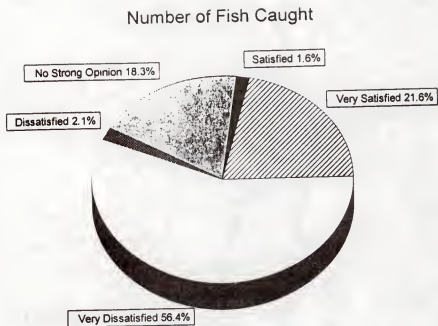


Figure 4. Angler satisfaction with total catch (top figure) and size of fish (bottom figure) caught in Hauser Reservoir.

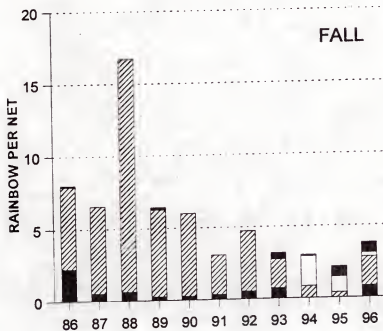
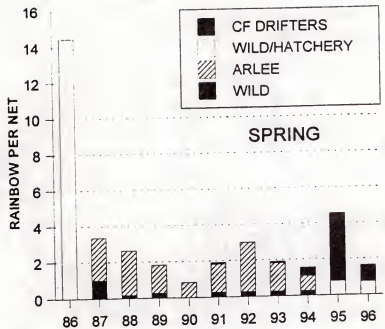


Figure 5. Spring (top graph) and fall (bottom graph) catch rates for rainbow trout in floating gill nets in Hauser Reservoir.

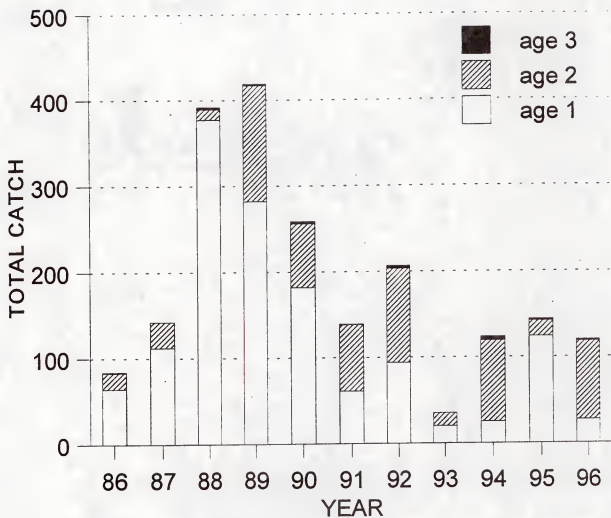


Figure 6. Total summer (July - September) catch of kokanee in vertical gill nets in Hauser Reservoir.

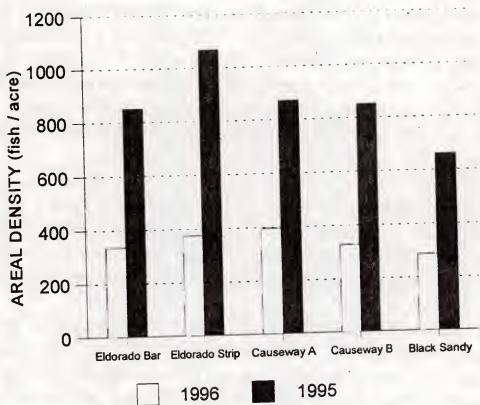


Figure 7. Areal densities (fish / acre) in Hauser Reservoir. Sample areas are shown on Figure 1.

HOLTER RESERVOIR

Creel Surveys

Summer Creel: A total of 1,036 anglers were interviewed during the weekend summer creel on Holter Reservoir. Most of the anglers (63%) traveled from Great Falls and spent on average 4.4 hours fishing. Total catch from creeled anglers was 775 rainbow trout, 599 kokanee salmon, 165 yellow perch, 59 walleye, and 2 brown trout. Catch rates (fish per angler hour) were 0.21 for rainbow trout, 0.16 for kokanee and 0.04 for yellow perch. The combined catch rate for all species was surprisingly similar during the summer creel (Figure 8). The only exception in the seasonal pattern was a spike in the distribution caused by excellent kokanee fishing in June (0.38 kokanee per angler hour; Figure 8).

Catch rates and total harvest for rainbow trout are shown in Table 4. An estimated 47,000 rainbow trout were harvested in 1996. Creeled rainbow trout averaged 13.8 inches and 1.1 pounds. Mean length and weight of creeled rainbow trout was similar to the 10 year average. The condition factor was also unchanged at 39.2.

Since 1990, wild rainbow trout made up between 0% and 14% of the fish harvested by anglers in Holter Reservoir. In 1996, an estimated 10% of the rainbow trout harvested were wild fish. Wild rainbow trout appear to be less susceptible to anglers than hatchery fish. The average contribution of wild fish caught in horizontal nets is about 42% (Figure 10).

In 1996, an estimated 32,000 kokanee were harvested from Holter Reservoir. Kokanee harvest was more than double the mean from the previous seven years (14,000; Table 4). The increase in harvest resulted from a record year class of age-2 kokanee. The abundance of age-2 kokanee was not a surprise given the record number of age-1 kokanee caught in vertical gill nets the previous year (Figure 12). The average size of kokanee in the creel was 14.1 inches and 1.24 pounds. Overall catch rates for yellow perch were the lowest on record (0.04 perch per hour; Table 4). Approximately 50,000 yellow perch were harvested in 1996. In a normal year, about 300,000 perch are

harvested from Holter Reservoir (Table 4). Average length of yellow perch in the creel was 9.5 inches total length. Results from the angler satisfaction survey showed that 46.6% of anglers were very dissatisfied with fishing on Holter Reservoir compared to 33.4% who were very satisfied (Figure 9). The majority of anglers (61.4%) also reported that they were very satisfied with fish size (Figure 9).

Table 4. Summer catch rates, mean size, and harvest of selected species in Holter Reservoir. Harvest estimates include winter ice fishing.

Year	RAINBOW			KOKANEES			YELLOW PERCH		
	Catch rate (fish/hr)	Mean Size (inches)	Harvest (X 1000)	Catch rate (fish/hr)	Mean Size (inches)	Harvest (X 1000)	Catch rate (fish/hr)	Mean Size (inches)	Harvest (X 1000)
1986	0.34	13.9	-	0.01	16.9	-	0.16	-	-
1987	0.37	13.8	-	0.01	16.7	-	0.39	8.8	-
1988	0.32	13.7	-	0.01	16.8	-	0.37	-	-
1989	0.27	14.5	57.1	0.01	16.1	2.1	0.85	9.0	330.0
1990	0.26	14.2	59.2	0.11	16.1	24.3	0.53	9.2	297.2
1991	0.27	12.6	62.3	0.10	15.2	22.4	0.40	8.6	237.7
1992	0.22	14.1	53.2	0.09	16.6	20.4	0.52	8.9	492.9
1993	0.14	15.9	33.7	0.06	16.1	12.0	0.22	9.1	313.2
1994	0.03	14.7	10.4	0.06	16.2	13.4	0.34	9.5	336.9
1995	0.16	14.1	20.1	0.03	15.7	4.3	0.08	9.5	108.6
1996	0.21	13.8	47.4	0.16	14.1	32.1	0.04	9.5	50.3
Mean	0.24	14.1	42.9	0.06	16.0	16.4	0.35	9.1	270.9

Harvest estimates for 1986 - 88 were not estimated because creel surveys were not completed during winter months.

Winter Creel: A total of 160 anglers were interviewed during the ice fishing season on Holter Reservoir. Catch rates were 0.65 for yellow perch and 0.25 for rainbow trout. Results from the 1996 ice fishing season indicated that perch numbers were very low. Since winter creel began in 1989, the mean catch rate for yellow perch was 3.0 fish per angler hour. Perch fishing peaked in 1992 at 5.6 perch per angler hour (Table 5). Unlike the perch fishery, catch rates for rainbow trout exceeded the 7 year mean of 0.17. Most of the rainbow creeled (78%) were between 9 and 12 inches. That size of trout reflects age-0 Arlee strain rainbow trout planted June 1995. No kokanee were creeled on Holter Reservoir during the 1996 ice fishing season.

Table 5. Anglers catch rates on Holter Reservoir during the Ice fishing season. Catch rates for walleye and brown trout were less than 0.01 for all years.

year	# of interviews	total catch	rainbow trout	kokanee salmon	yellow perch
1989	493	4704	0.23	<0.01	2.95
1990	346	3597	0.24	<0.01	3.05
1991	547	6162	0.27	0.02	3.57
1992	166	2930	0.23	<0.01	5.60
1993	486	4487	0.09	<0.01	2.73
1994	349	393	0.07	<0.01	3.79
1995	121	72	0.06	0.00	1.69
1996	160	402	0.25	0.00	0.65

Trend Netting and Hydroacoustic Estimates of Fish Abundance

Floating Gill Nets: Species composition for spring and fall horizontal gillnets are shown in Appendix E - H. In floating gill nets, rainbow catch per gill net was 2.4 in the spring and 9.3 in the fall. Spring results were similar to previous years. Fall catch was the highest recorded since 1987 and was made up of mostly hatchery rainbow trout (79%; Appendix F). Of the hatchery fish, 80% were between 12" and 14" total length and were Eagle Lake strain stocked spring 1996. The remaining hatchery fish were Arlee strain stocked in 1995 and averaged about 16". Similar to the fall percentages, approximately 86% of the trout sampled in spring horizontal nets were of known hatchery origin. Figure 10 shows the historical contribution of wild rainbow trout in horizontal gill nets.

The fall floating nets revealed a record catch of age-2 kokanee (Figure 11). About 13.0 age-2 kokanee were sampled per net during the fall season. Most of the age-2 kokanee sampled were mature. Females collected for fecundity estimates averaged 16.2", weighed 1.79 lbs and carried approximately 1,700 eggs. The record number of kokanee caught in 1996 was predictable given the extremely high catch of age-1 kokanee the previous year (Figure 11). Many of the age-2 kokanee sampled in Holter Reservoir may have been flushed in from Hauser Reservoir during record spill that occurred spring of 1995.

Vertical Gill Nets: Vertical gill net trends mirrored fall horizontal results, with kokanee numbers exploding in 1995 (Figure 12). Summer catches of kokanee in 1995 and 1996 were extremely high compared to previous years. Similar to horizontal nets, the age-1 cohort that appeared in 1995 continued to dominate the population structure as age-2 kokanee in 1996 (Figure 12).

Beach Seine: Beach seine results are shown in Table 6. The catch of yellow perch in 1996 was the lowest on record. Walleye numbers also dropped in 1996, while suckers increased.

Table 6. Beach seine results (number of fish per tow) in Holter Reservoir since 1990.

Year	Number of Tows	Y. Perch	Sucker	Walleye
1990	7	125.1	N/A	0.0
1991	20	274.2	N/A	2.5
1992	20	622.2	147.2	0.0
1993	20	38.0	52.5	<0.1
1994	19	169.7	288.6	0.0
1995	16	80.3	120.9	1.0
1996	19	32.4	385.5	0.6

Hydroacoustic Estimates of Fish Abundance: Total pelagic fish abundance in the reservoir was an estimated 1.59 million. Fish densities were greatest in the upper-reservoir (514 fish / acre), followed by the open area near the dam (336 fish / acre) and the oxbow bend (258 fish / acre). Total fish abundance from the Oxbow Bend to the face of the Dam was 478,000 (s.d. 347,000). Based on the ratio of fish caught in vertical gill nets, approximately 74% of the targets were kokanee salmon. White sucker and rainbow trout proportions were similar at 13%. Therefore, the total population estimates for kokanee and rainbow trout were 353,000 and 63,000, respectively. It is important to note, that the above estimates are for the area from the Oxbow Bend to the face of the Dam. Targets in the other areas of the reservoir could not be partitioned by species because netting was not completed in those areas. Mean transect densities for all arease of the reservoir are shown in Appendix M.

Trap Netting: Trap net results are shown in Table 7. Trap nets were fished from 29 April to 13 May. A total 97 walleye, 2,025 yellow perch, and 247 rainbow trout were sampled in 45 net nights. Sampling effort was concentrated in the Oxbow Bend. Mean length of walleye caught in trap nets has been very similar among years. Average lengths for males is about 22" and 26" for females. Perhaps the most interesting result from the trap net data was the increase in percent of walleye that were previously tagged. In 1995 only 3% had been previously tagged. In 1997, 34% of the walleye were previously tagged.

Table 7. Numbers and species of fish captured in trap nets in Holter Reservoir.

year	Dates	nets	Walleye				Yellow Perch		Rainbow
			total catch		mean length		Total	# clip	
			♂	♀	♂	♀			
1995	4/26 - 5/12	52	250	59	22.1	26.6	3,281	1,251	84
1996	4/25 - 5/17	69	181	60	22.6	25.9	1,558	1,100	350
1997	4/29 - 5/13	45	66	29	22.0	24.8	2,025	1,638	247

Walleye tagging: In an effort to estimate angler harvest, walleye caught in trend and trap net operations have been tagged with dangler or jaw tags. The tagging effort began in 1988. A total 889 walleye have been tagged. To date, 119 (13.4%) of the tags have been returned. Surprisingly, 18 of the 28 (64%) tag returns from 1995 and 1996 were from walleye caught below Holter Dam. Annual tagging and return data are presented in Appendix L.

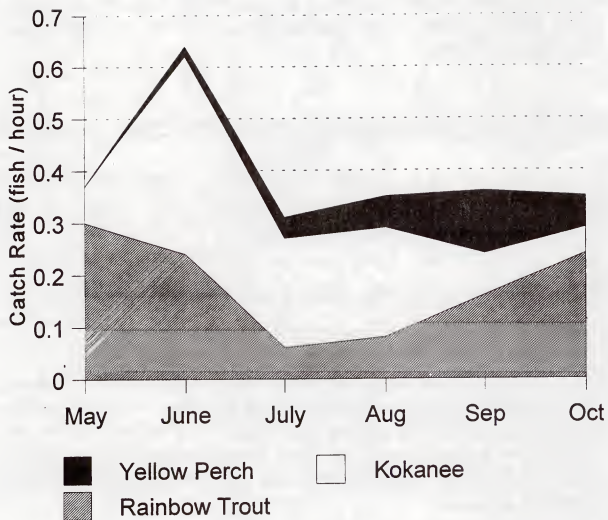
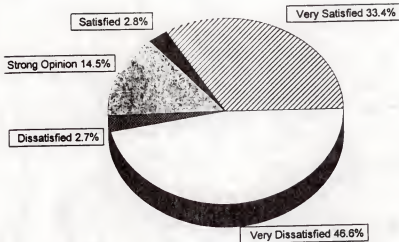


Figure 8. Seasonal catch rates for selected species in Holter Reservoir.

Number of Fish Caught



Size of Fish Caught

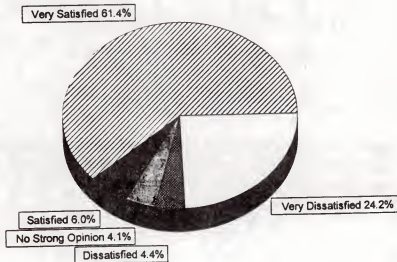


Figure 9. Results from angler satisfaction survey on Holter Reservoir. Angler satisfaction with total catch (top figure) and size of fish (bottom figure) are shown.

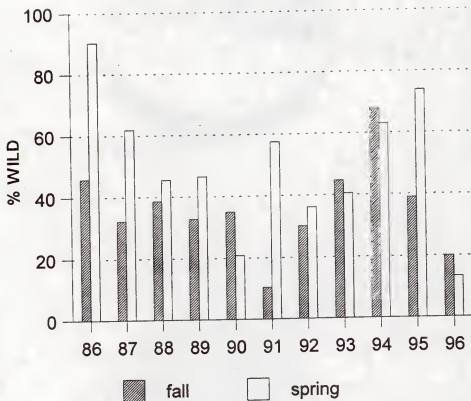


Figure 10. The contribution (%) of wild rainbow trout caught in floating horizontal gill nets in Holter Reservoir. On average, wild fish made up 37.6% of the fall catch and 53.6% of the spring catch.

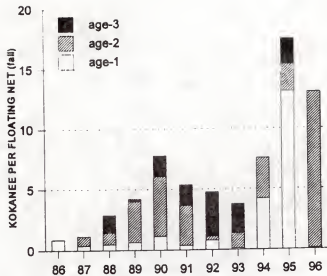


Figure 11. Kokanee catch in fall floating gill nets in Holter Reservoir.

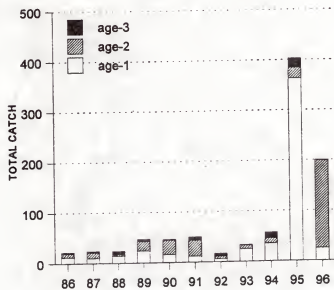


Figure 12. Total catch of kokanee in vertical gill nets between July and September in Holter Reservoir.

APPENDICES

Appendix A. Percent composition by species for spring floating gillnet catches in Hauser Reservoir.

SPECIES	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
RB	29.0	9.7	17.7	13.2	5.4	7.8	12.7	17.2	7.0	39.0	9.5
LL	0.2	1.3	0.6	2.0	1.6	0.7	3.0	1.6	2.0	1.0	1.9
KOK	2.9	36.0	71.3	74.2	88.6	85.6	47.6	68.0	56.1	58.1	73.4
MWF	0.2	0.0	1.2	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0
WE	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.4	0.4	0.0	0.0
YP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.0	0.0
LNSU	52.9	35.8	6.1	5.3	1.6	1.8	10.9	2.5	20.9	1.0	5.7
WSU	13.8	16.4	3.1	5.3	2.7	1.5	24.3	9.0	12.7	1.0	9.5
CARP	0.5	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0
U.CHUB	0.5	0.8	0.0	0.0	0.0	2.2	0.0	0.8	0.1	0.0	0.0
TOTAL #	448	383	164	151	185	271	267	122	244	105	158
# NETS	9	10	10	9	11	11	11	9	11	9	9

Appendix B. Percent composition by species for fall floating gillnet catches in Hauser Reservoir.

SPECIES	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
RB	31.3	44.2	42.0	20.9	16.5	8.1	15.0	17.7	17.6	13.1	17.5
LL	2.5	1.2	1.4	0.9	0.5	0.7	0.3	0.5	1.1	2.2	1.3
KOK	57.3	25.1	47.9	73.2	79.3	70.0	81.5	76.3	54.0	81.4	74.6
MWF	4.3	0.0	0.9	0.3	0.7	0.5	0.6	0.5	0.5	0.5	0.0
WE	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	1.8
YP	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LNSU	1.4	12.9	2.5	0.9	0.2	0.0	0.3	0.0	14.4	0.0	0.9
WSU	1.1	16.0	0.5	0.3	0.2	0.0	0.9	1.0	12.3	2.2	1.8
CARP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
U.CHUB	1.4	0.6	4.8	3.5	2.5	20.2	1.4	4.5	0.0	0.5	1.8
TOTAL #	281	163	438	339	401	420	346	198	187	183	228
# NETS	11	11	11	11	11	11	11	11	11	11	11

Appendix C. Percent composition by species for spring sinking gillnet catches in Hauser Reservoir.

SPECIES	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
RB		0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0
LL		1.5	1.2	0.9	0.7	1.2	0.2	2.6	3.0	1.4	1.4
KOK		1.1	4.2	1.7	2.7	3.1	0.7	11.5	7.0	1.9	0.2
MWF		3.8	5.4	2.4	2.0	3.0	1.7	2.0	1.5	2.7	0.9
WE		0.0	0.0	0.2	0.0	0.0	0.7	0.0	0.7	0.0	0.0
YP		4.7	10.6	5.8	13.5	13.7	21.5	17.1	12.9	3.1	5.1
LNSU		23.0	17.9	22.3	19.5	20.9	19.6	23.5	31.4	18.6	14.3
WSU		65.5	60.0	66.0	58.4	55.7	53.3	40.8	39.9	70.7	75.6
CARP		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.7
U.CHUB		0.2	0.5	0.3	3.1	1.9	0.0	0.8	2.6	0.2	0.0
BURBOT		0.0	0.0	0.2	0.0	0.2	2.1	1.8	0.7	0.4	1.8
SM.BUFF		0.0	0.0	0.2	0.0	0.3	0.2	0.0	0.0	0.0	0.0
TOTAL #	0	473	407	574	548	635	424	392	271	484	434
# NETS	0	5	6	6	6	6	6	6	6	6	6

Appendix D. Percent composition by species for fall sinking gillnet catches in Hauser Reservoir.

SPECIES	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
RB	0.7	1.4	0.5	1.8	0.3	0.7	0.7	0.2	0.4	0.3	0.4
LL	1.0	0.4	0.5	0.0	0.7	0.4	1.0	1.0	0.9	0.5	1.4
KOK	0.4	4.2	9.1	18.3	11.1	20.6	7.7	6.8	4.0	18.9	1.8
MWF	3.6	2.3	2.6	0.5	2.1	1.7	1.2	1.6	0.9	0.3	0.7
WE	0.0	0.0	0.0	0.0	0.0	0.6	0.1	0.2	0.2	0.0	0.7
YP	4.9	9.3	4.3	3.5	3.8	11.2	8.1	10.7	7.4	8.0	12.5
LNSU	28.9	16.1	24.1	14.7	16.1	16.6	18.3	18.7	12.0	18.1	21.4
WSU	60.5	66.0	58.3	59.4	63.4	45.0	59.3	57.3	45.1	50.5	59.4
CARP	0.0	0.0	0.0	0.2	0.0	0.0	1.0	0.0	29.1	0.2	0.0
U.CHUB	0.0	0.1	0.1	1.3	2.3	1.7	1.8	1.4	0.7	0.3	0.4
BURBOT	0.0	0.2	0.5	0.0	0.2	0.4	0.7	1.2	0.2	2.8	1.4
SM.BUFF	0.0	0.2	0.5	0.0	0.0	1.1	0.0	1.0	0.0	0.0	0.0
TOTAL #	700	839	648	600	577	705	765	513	902	576	562
# NETS	5	6	6	6	6	7	7	7	7	7	7

Appendix E. Percent composition by species for spring floating gillnet catches in Holter Reservoir.

SPECIES	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
RB	25.5	47.1	64.3	25.0	61.5	34.5	39.2	26.1	34.0	63.9	36.7
LL	0.0	1.6	1.2	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0
KOK	0.6	2.6	1.7	2.7	28.2	46.9	11.7	6.2	30.1	13.9	51.7
MWF	2.5	1.6	1.2	0.9	0.0	1.2	3.3	0.0	1.0	0.0	0.0
WE	5.0	7.4	4.1	1.8	5.1	13.9	0.8	3.7	5.8	2.8	1.7
YP	0.0	20.1	18.7	8.9	0.0	0.0	38.3	29.8	14.6	0.0	0.0
LNSU	40.4	10.1	4.1	38.4	1.3	0.4	0.0	8.1	7.8	2.8	5.0
WSU	24.8	7.9	3.5	22.3	2.6	2.7	5.8	26.1	4.9	16.7	5.0
CARP	1.2	1.6	1.2	0.0	0.0	0.4	0.8	0.0	1.9	0.0	0.0
U.CHUB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL #	161	189	171	112	78	258	120	161	103	36	60
# NETS	6	8	8	8	8	9	9	9	9	9	9

Appendix F. Percent composition by species for fall floating gillnet catches in Holter Reservoir.

SPECIES	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
RB	77.2	76.6	41.5	52.1	34.7	53.7	35.3	42.0	42.5	20.0	39.1
LL	0.8	2.2	1.9	0.9	0.0	1.9	1.3	0.0	0.7	0.0	0.5
KOK	4.9	4.8	21.7	33.0	56.5	39.8	28.6	49.3	46.6	76.5	54.4
MWF	3.3	0.0	2.8	0.9	1.6	2.8	0.0	0.0	1.4	0.0	0.0
WE	9.7	0.5	0.0	2.6	0.0	0.0	0.7	2.9	0.0	2.0	5.6
YP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LNSU	3.3	6.9	12.3	7.0	6.5	0.9	20.0	1.4	2.7	1.0	0.0
WSU	0.8	9.0	19.8	2.6	0.8	0.9	14.0	4.3	6.2	0.5	0.5
CARP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
U.CHUB	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL #	123	188	106	115	124	108	150	69	146	205	215
# NETS	7	8	8	9	9	8	9	9	9	9	9

Appendix G. Percent composition by species for spring sinking gillnet catches in Holter Reservoir.

SPECIES	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
RB		0.9	1.4	1.1	1.0	0.7	0.2	0.4	0.5	2.3	0.7
LL		0.8	0.2	0.2	0.7	0.1	0.1	0.0	0.0	0.6	0.5
KOK		0.0	0.3	0.0	0.0	0.6	0.1	0.1	0.2	1.0	3.1
MWF		1.7	3.6	5.1	4.0	5.8	1.8	1.5	2.0	1.0	2.2
WE		1.6	2.0	2.8	2.0	1.4	1.6	1.9	5.3	1.2	3.9
YP		57.2	34.0	29.5	39.2	50.4	43.4	42.3	28.1	30.9	9.9
LNSU		16.5	17.6	11.2	11.4	11.9	5.4	10.4	12.8	6.0	17.6
WSU		21.2	40.7	49.7	41.4	29.1	46.9	43.2	51.0	56.6	61.6
CARP		0.1	0.0	0.4	0.0	0.0	0.3	0.1	0.2	0.2	0.5
U.CHUB		0.0	0.2	0.0	0.3	0.0	0.0	0.1	0.0	0.2	0.0
TOTAL #	0	838	658	545	597	894	921	743	549	514	414
# NETS	0	5	6	6	5	6	6	6	6	6	6

Appendix H. Percent composition by species for fall sinking gillnet catches in Holter Reservoir.

SPECIES	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
RB	4.3	2.5	2.6	1.8	3.1	4.4	0.8	1.5	2.7	3.9	1.8
LL	0.2	0.3	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.2
KOK	0.4	0.2	0.5	0.6	1.9	1.6	1.4	1.5	1.2	2.1	6.4
MWF	1.8	2.0	0.5	1.8	4.3	1.3	2.2	1.5	0.2	0.6	0.7
WE	2.5	3.1	1.3	5.2	2.9	3.0	4.2	6.0	2.4	0.6	6.0
YP	24.0	28.8	21.8	10.6	16.0	11.3	21.5	9.4	10.0	9.0	2.9
LNSU	24.0	21.5	21.9	20.4	15.4	20.3	15.5	17.0	23.4	12.9	20.0
WSU	42.8	41.6	51.2	59.6	56.2	58.1	53.8	62.3	60.0	70.0	61.4
CARP	0.0	0.0	0.2	0.0	0.2	0.0	0.4	0.5	0.0	0.8	0.7
U.CHUB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BURBOT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
TOTAL #	551	601	611	500	486	566	502	401	410	513	451
# NETS	6	6	6	6	6	6	6	6	6	6	6

Appendix I. Creel survey results, harvest and gillnet trends for kokanee salmon in Hauser Reservoir.

Year	Summer Catch Rate (fish / hr)	Winter Catch Rate (fish / hr)	Mean Size (inches) Summer Creel	Harvest (X 1000)	Spring Floaters (fish / net)	Fall Floaters (fish / net)	Summer Verticals (fish / night)
1986	0.10	-	16.6	-	1	15	28
1987	0.13	-	15.6	-	14	7	47
1988	0.24	-	16.3	-	12	19	159
1989	0.42	0.23	14.6	101.4	10	23	156
1990	0.22	0.18	15.7	60.9	15	29	120
1991	0.46	0.18	14.7	141.3	21	27	48
1992	0.22	0.30	15.8	78.4	12	26	50
1993	0.22	0.47	16.0	89.3	9	14	18
1994	0.15	0.03	14.8	37.1	13	9	41
1995	0.11	0.06	17.0	29.1	6	14	76
1996	0.11	0.00	14.1	17.4	11	16	46
Mean	0.22	0.18	15.6	69.4	11	18	72

Appendix J. Stocking records, creel survey results, harvest and gillnet trends for rainbow trout in Hauser Reservoir.

Year	Stocking (X 1000)	Summer Catch Rate (fish / hr)	Winter Catch Rate (fish / hr)	Mean Size (inches) Summer Creel	Harvest (X 1000)	Spring Floaters (fish / net)	Fall Floaters (fish / net)	% wild from Floaters
1986	213	0.25	-	13.5	-	14	8	10
1987	213	0.24	-	14.2	-	3	7	16
1988	212	0.24	-	15.8	-	3	17	4
1989	200	0.12	0.18	13.7	25.5	2	7	7
1990	125	0.10	0.11	14.9	27.8	1	6	4
1991	138	0.02	0.08	15.3	7.8	2	3	13
1992	126	0.05	0.02	15.1	13.0	3	5	11
1993	100	0.05	0.04	16.3	16.5	2	3	20
1994	105	0.02	0.01	16.6	4.2	2	3	-
1995	107	0.05	0.04	17.5	11.5	5	2	-
1996	100	0.05	0.04	17.5	11.7	2	4	-
Mean	149	0.11	0.07	15.5	14.8	4	6	11

%wild in 1994-96 were not estimated because hatchery fish were not marked in 1994.

Appendix K. Stocking records, catch rates, harvest and gillnet trends for rainbow trout in Holter Reservoir.

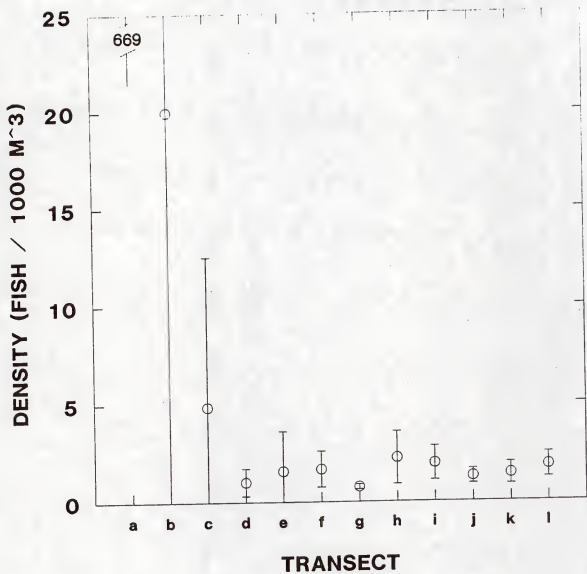
Year	Stocking (X 1000)	Summer Catch Rate (fish / hr)	Winter Catch Rate (fish / hr)	Mean Size (inches) Summer Creel	Harvest (X 1000)	Spring Floaters (fish / net)	Fall Floaters (fish / net)	% wild from Floaters
1986	357.3	0.34	-	13.9	-	7	14	61
1987	323.0	0.37	-	13.8	-	11	18	44
1988	322.9	0.32	-	13.7	-	14	6	44
1989	350.0	0.27	0.23	14.5	57.2	4	7	37
1990	347.3	0.26	0.24	14.2	59.2	6	5	27
1991	420.1	0.27	0.27	12.6	62.3	10	7	37
1992	382.8	0.22	0.23	14.1	53.2	5	6	33
1993	325.0	0.14	0.09	15.9	33.7	5	3	42
1994	290.5	0.03	0.07	14.7	10.4	4	7	66
1995	317.5	0.16	0.06	14.1	20.1	3	5	52
1996	100.0	0.21	0.25	13.8	47.4	2	9	20
Mean	321.5	0.24	0.18	14.1	42.9	6	8	42

Appendix L. Holter walleye tagging summary. Dangler tags were used between 1988 and 1995. In 1996, most of the walleye were tagged with both jaw and dangler tags.

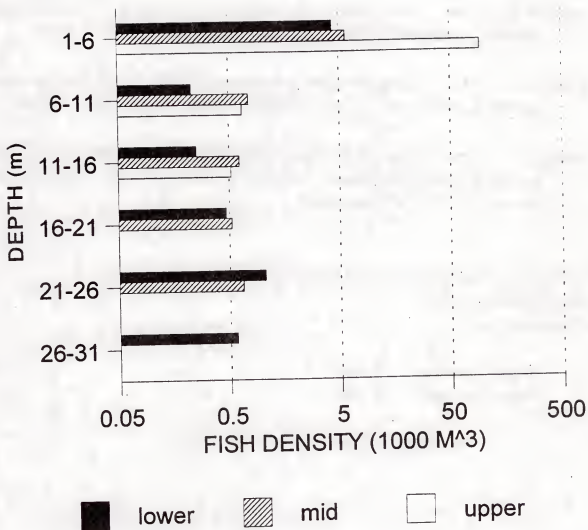
number of tag returns by anglers													
Year	Number Tagged	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Total	(%)
1988	100	6	2	1	6	4	5	1	1	0		26	26.0
1989	30		2	2	0	0	0	0	1	0		5	16.7
1990	121			3	10	16	7	3	2	1		42	34.7
1991	63				1	4	4	1	0	0		10	15.9
1992	42					2	1	1	0	0		4	9.5
1993	18						0	5	0	0		5	27.8
1994	19							0	0	1		1	5.3
1995	284								5	10	1	16	5.6
1996	212									7	3	10	4.7
	Totals	6	4	6	17	26	17	11	9	19	4		

number of previously tagged walleye sampled in trap nets												
Year	# Tagged	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Total
1988	100								1	0	0	1
1989	30								2	0	0	2
1990	121								2	3	1	6
1991	63								0	0	0	0
1992	42								0	0	0	0
1993	18								1	0	0	1
1994	19								2	1	0	3
1995	284									28	10	38
1996	212										19	19
1997	91											
	Totals								8	32	30	
	% of catch								3	15	33	

The percent of walleye caught in trap nets that were previously tagged increased from 3% in 1995 to 33% in 1997.



Appendix M. Hydroacoustic estimates of fish densities in Holter Reservoir in 1996.



Appendix N. Depth distribution of targets in Holter Reservoir in 1996.

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Prepared by: David Teuscher and Troy Humphrey

Date: December, 1997

Waters referred to:

Hauser Reservoir 17-9056

Holter Reservoir 17-9136